[WP/Ma/0206/SH]

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AGRICULTURAL MEMORANDUM NO. 1038

AN APPRAISAL OF TWO METHODS FOR PREDICTING POTATO BLIGHT IN 1984

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SUMMARY

Reported dates of potato blight outbreaks during 1984 are compared with those predicted by two methods using meteorological information. Smith periods (Smith 1956) correctly suggested an early season risk in Wales and E. Anglia but failed to predict outbreaks in Central England later in the season. Sparks' system (Sparks 1984) correctly indicated a much smaller area at early season risk and identified every other risk area before an outbreak was reported.

INTRODUCTION

Smith introduced his warning scheme, based on 90% relative humidity, as an alternative to the use of the existing Beaumont criteria. Comparison between predicted and actual outbreak dates using those two methods indeed showed the Smith method to be an improvement (Smith 1976) - to an implied success rate of between 70% and 90%. Large (1956) suggested that 2 or 3 generations of the fungus would be required before spraying was justified. Smith (1974), aware of the limitations of his system, attempted to improve it by formulating rules based on cumulative hours of high RH and by imposing cut-off dates. These rules have sometimes been ammended by plant pathologists in the light of their own experience.

In 1983 a scheme which attempted to model the progress of the disease (Sparks 1980) was introduced but met with little enthusiam: partly because of the difficulty in displaying and interpreting the results and partly because the crop was assumed to develop according to fixed calendar dates. During the folowing winter the model was further developed and simplified to calculate infection risks for both open and dense crop canopies (Sparks 1984a) thus enabling a plant pathologist to select the risk appropriate to the crops in his own area at any time.

It was suggested (Sparks 1984b) that an infection risk period started another cycle of spore generation if it occurred within 8 and 22 days of a previous risk period. This hypothesis was tested (Sparks 1984b) by comparing the number of such multiplicative cycles of generations (using calculated risk periods for 9 stations in the Eastern Region) with reported outbreak dates for the years 1978-83.

In each year the first reported outbreak date was preceeded by 3 generation cycles at, at least, one station. The mean difference between the start of the third generation and the date of the first reported outbreak was 13½ days (sd = 4 days).

This paper discusses how both schemes faired nationally in 1984.

ANALYSIS

Smith periods and Sparks infection criteria were extracted from the daily plant disease telex message for 39 stations in England and Wales and the total number of Smith periods and Sparks multiplicative generation counts plotted at weekly intervals. The infection risk period appropriate to a sparse crop canopy (LC) was used until 15 June for earlies and 1 July for maincrop potatoes except in Northern Region where maincrops were taken as meeting across the rows on 15 July. After these dates the risk period calculated for a full crop cover (HC) was deemed suitable.

Reports of blight outbreaks were extracted from the weekly bulletins issued by the Plant Disease Intelligence Unit and supplemented with the original telexed regional reports. Each new reported outbreak was plotted for the week ending on the report date. Information about the disease in irrigated crops was ignored.

RESULTS

Maps showing reported outbreaks, number of Smith periods and number of possible multiplicative generations at each observing station were drawn on a weekly basis. The situation on various dates throughout the season is described below and the maps for most of these dates are shown in figures 1a-1f.

Situation by 2 July Fig 1a Earlies

Assuming the canopy dates in the previous section then 3 multiplicative generations could have occurred at Aberporth, St Mawgan, Herstmonceux and Hemsby with at least one Smith period over a slightly larger area including South Wales, North Devon and Cornwall. Primary foci were reported on earlies in Dyfed and West Norfolk with 2 cases of blighted dumps also in Norfolk. A primary focus in maincrop King Edwards was noted at Trawsgoed on 24 June where the crop was meeting across the rows by 25 June; in this case the third generation was not completed until 1 July.

Situation by 16 July Fig 1b Maincrops

Further Smith periods had occurred in Wales and the West Country; the Sparks system gave 3 multiplicative generations in these areas and also in Suffolk and Essex. Blight was reported on the Welsh coastal strip but not in East Anglia.

Situation by 30 July Maincrop

Apart from Valley and Aberporth no Smith periods occurred during the preceedings fornight whereas the Sparks system put all the western counties and the east coast, south of the Humber at risk. Further disease spread was observed near Aberystwyth; there was a new outbreak in Cheshire.

Situation by 6 August Fig 1c

Smith periods occurred in North Yorkshire and North Linconshire, although a further multiplicative generation was predicted by the Sparks system in most areas the critical region (according to this criterion) was only extended to include Northumberland and Nottingamshire. Blight was reported in Wales, Somerset, Gloucester and near the meteorological station at Watnall (Notts).

Situation by 13 August Fig 1d

Parts of the Eastern Counties had their first Smith period but critical conditions did not occur elsewhere. The area at risk according to the Sparks system now included Southern England. Outbreaks of blight were noted in Lancashire and South Wales.

Situation by 20 August Fig 1e

Most of Central England and a few stations in the S and SE still had not experienced weather suitable for Smith criteria whereas the Sparks method put most of the country at risk, except for North Yorkshire and 3 stations in Central England. A spate of blight reports were received from the E Midlands mostly in the area with no Smith periods.

Situation on 10 September Fig 1f

Smith's criteria still showed most of Central England as a no risk area whereas at least 3 (maximum 10) multiplicative generations had been completed over the whole country. Blight was found in Cornwall Wales, Kent, E Anglia and E Midlands during the previous 2 weeks.

DISCUSSION

The reported outbreak in King Edwards at Trawsgoed was the only outbreak before 3 multiplicative generations (calulated by the Sparks system) had occurred at the nearest meteorological station (40 km away). This outbreak was unusual in that the spread was from a single primary focus rather than from several scattered foci which may well have gone unnoticed had it not been part of a carefully observed trial. From an advisory part of view this area already had warnings of likely disease incidence in forward crops (see situation by 2 July).

As part of that trial, plants were left unsprayed and the disease progress was recorded throughout the season. The relation between disease progress and the number of multiplicative generations (at Aberporth) is shown in Fig 2 - the relationship is exponential.

Outbreaks in earlies fitted in well with both the Sparks and Smith schemes and had timely warnings. Thereafter every blight report was preceeded by at least 3 generations under the Sparks system. Maps of both Smith and Sparks criteria show the general trend for 'spread' inland for the west and east coasts. However the Smith criteria failed to identify the inland areas at risk later in the season whereas the Sparks method succeeded. Notably, and perhaps fortuitously, blight was found near Watnall on 4 September after 5 possible multiplicative generations had been calculated for that station yet no Smith periods had occurred.

CONCLUSION

These results and those from Eastern Region in 1983 (Sparks 1984b) are sufficiently encouraging to warrant further investigations into the reliability of the Sparks system and it intended to extend the analysis back to 1975.

AGROMETEOROLOGICAL DEPARTMENT
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December 1984

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Sparks, W. R. (1984a). The definition of a new critical period for potato blight predication. Ag Mem No 1019.

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KEY FOR FIGURES 1a-1f

Reported outbreak.

Area with at least 3 multiplicative generations - Sparks system

2

Figures show number of Smith periods.

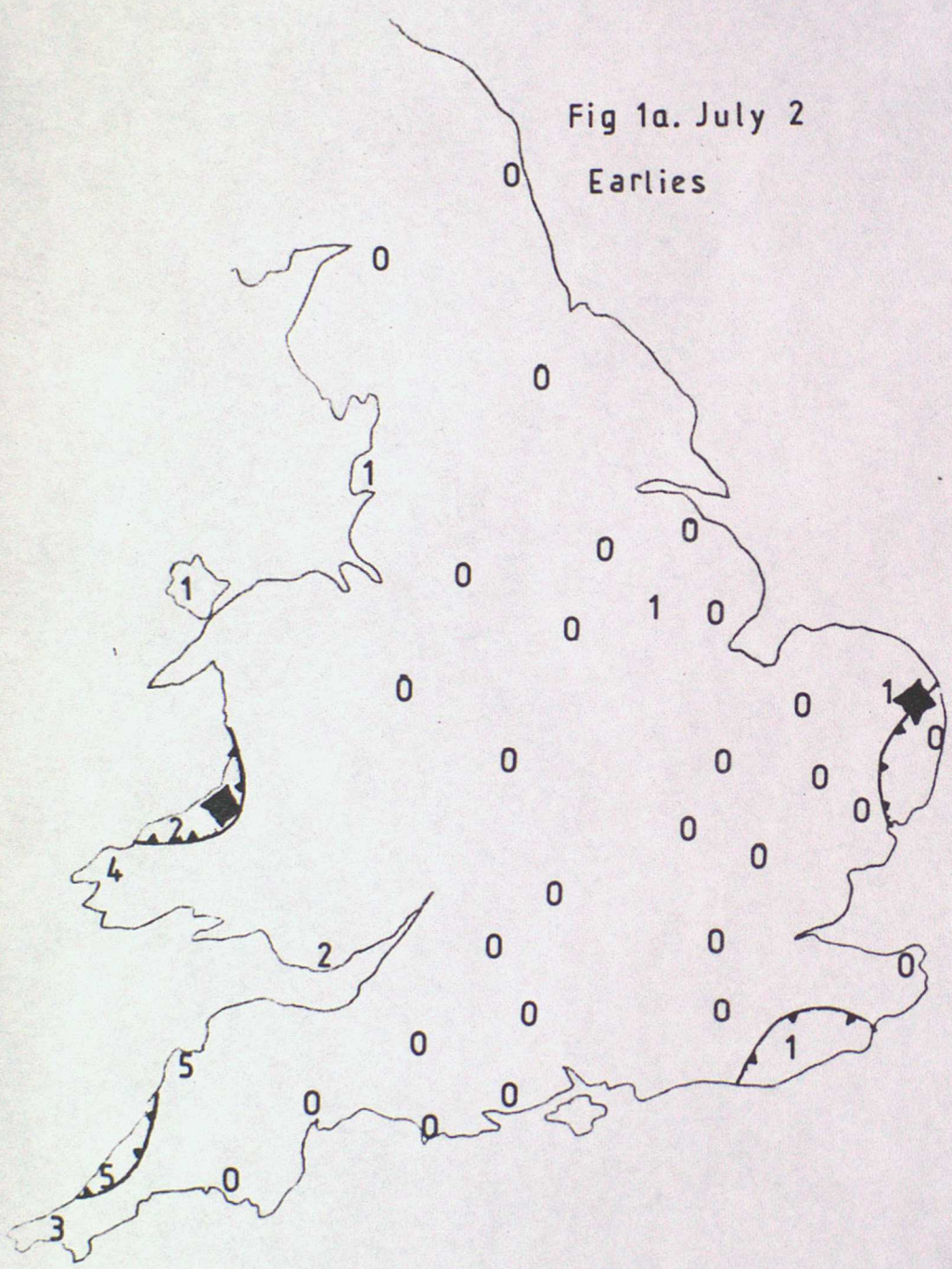

Fig 1a. July 2

Earlies

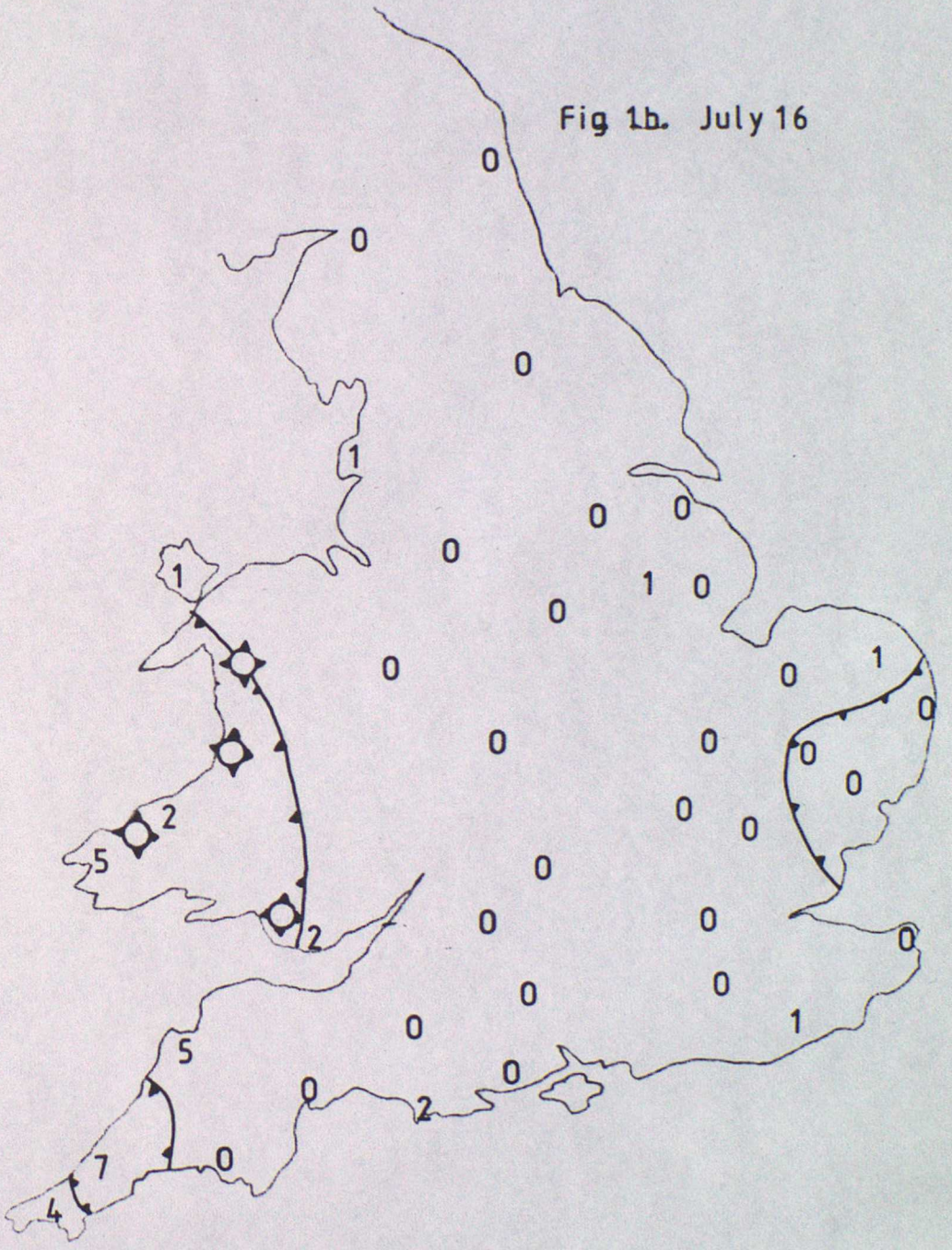

Fig 1b. July 16

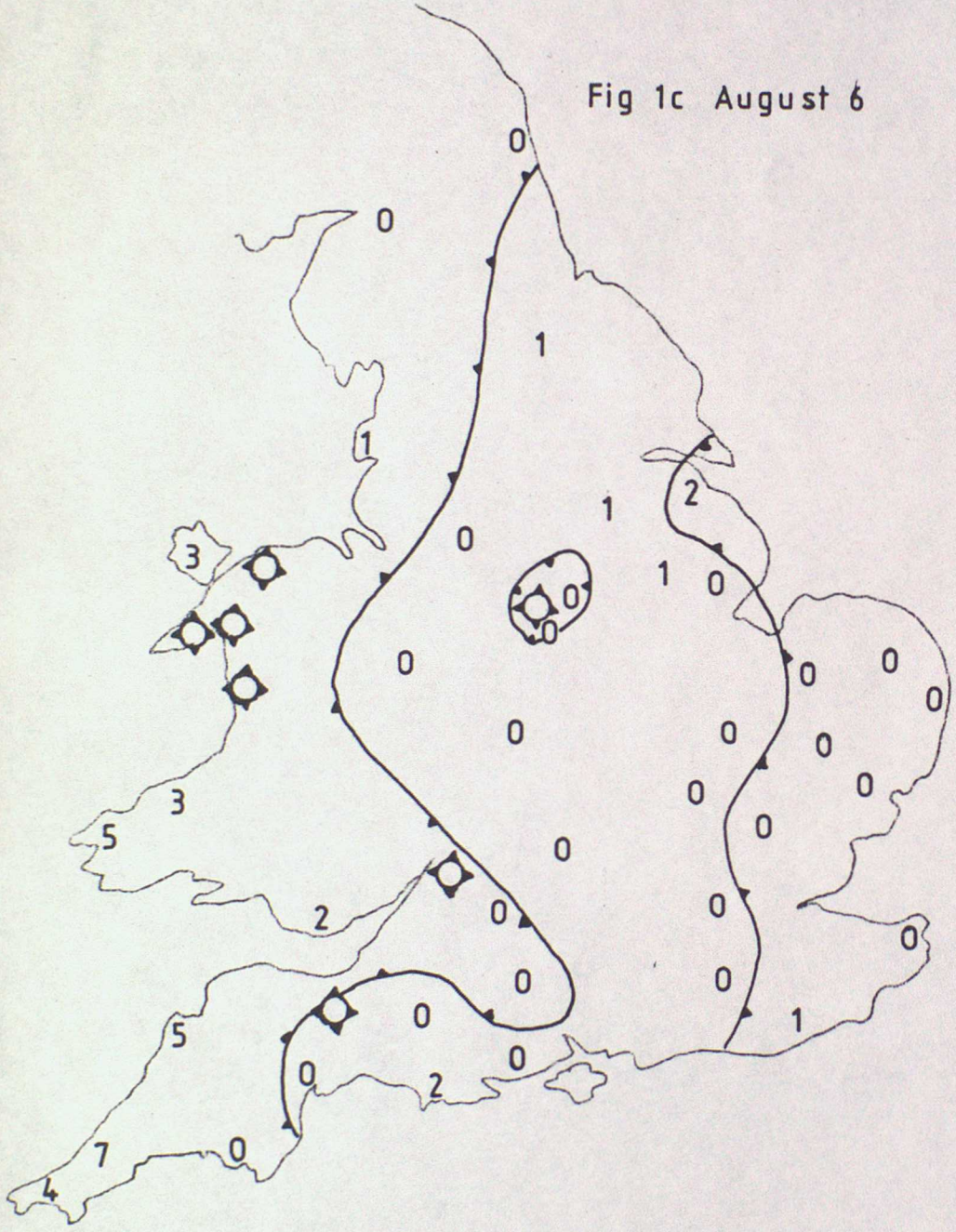

Fig 1c August 6

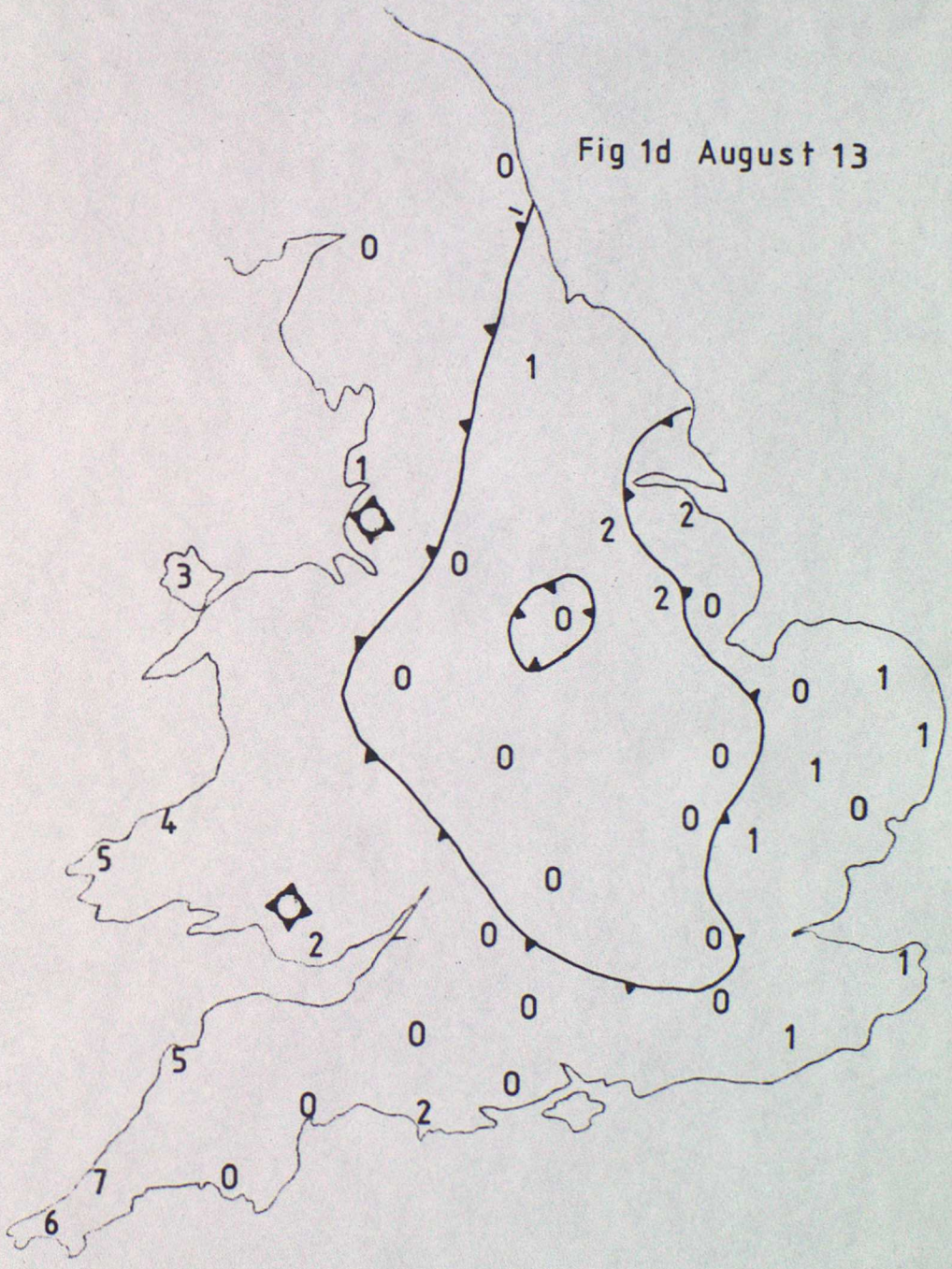

Fig 1d August 13

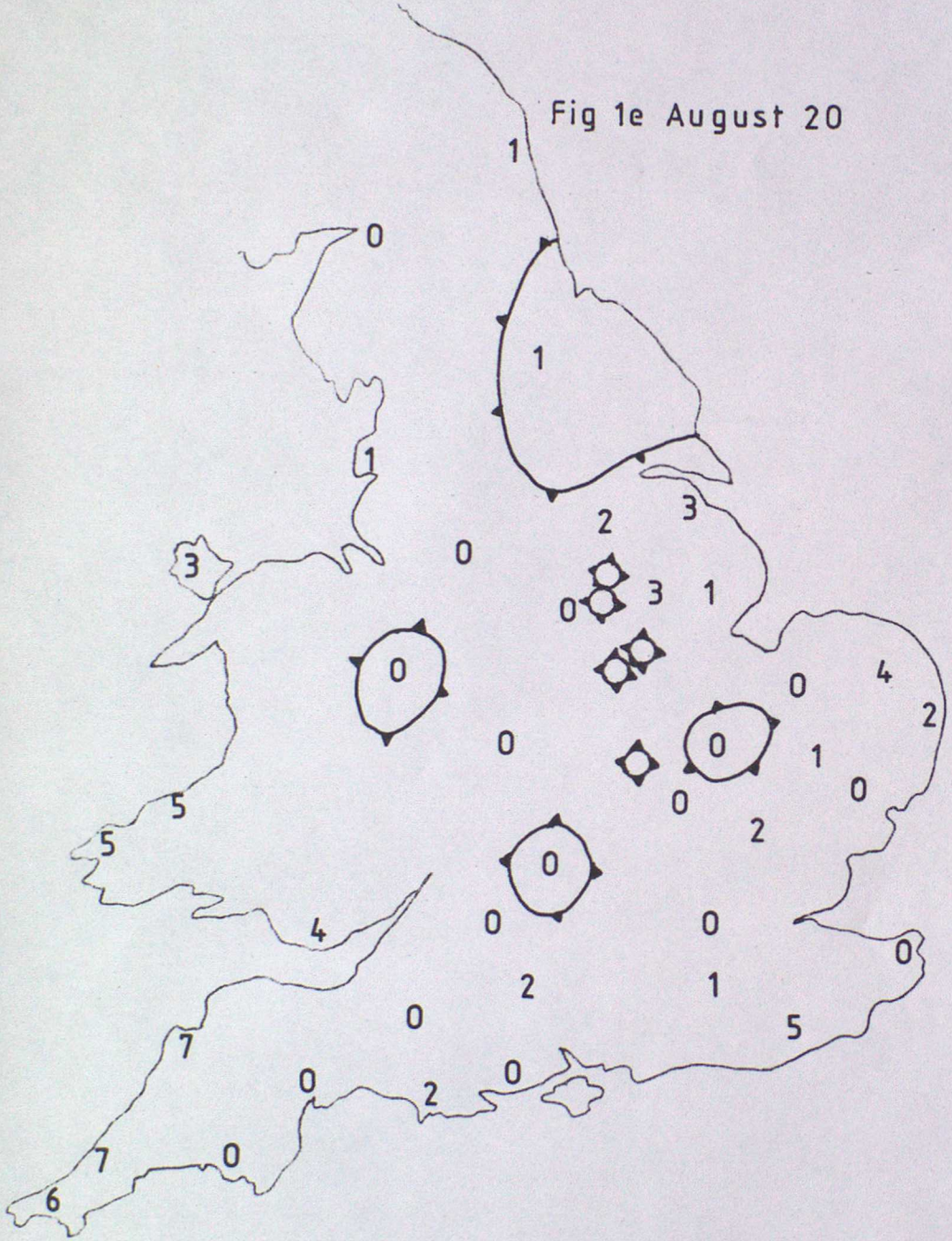

Fig 1e August 20

Fig 1f September 10

Figure 2
Potato Blight development
Trawsgoed 1984